

FURTHER STUDIES ON AUDIBLE VOCALIZATIONS OF THE AMAZON FRESHWATER DOLPHIN, *INIA GEOFFRENSIS*

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ABSTRACT: Evidence is presented indicating the absence of a *quasi*-pure tone or whistle type of sound production by the Amazon freshwater dolphin. A discussion and sonagrams are given of the audible squeal or screech often attributed to *Inia geoffrensis*.

Phonations of the toothed whales and dolphins fall roughly into three categories. These include two types which generically are related (Norris, 1969) and probably are produced by the same mechanism, as they both consist of discrete clicks. One type demonstrates a slower click repetition rate and is usually associated with environmental investigation (echolocation), whereas the other is made up of bursts of clicks of higher repetition rates of 150 per second or more (Caldwell, Caldwell and Evans, 1966b). The latter create tonal sounds variously labeled by such names as barks, squawks, screeches or squeaks. These are associated with behavioral situations wherein we find a positive correlation between the time of their emission and the usefulness of a signal that could cue conspecifics to approach or withdraw (Caldwell and Caldwell, 1967). The third type of sound, most frequently termed a whistle, is a *quasi*-pure tone sound that cannot be resolved into individual clicks. These are the harmonic emissions of Tավոլգա (1965: 9) and Evans (1967). All odontocetes probably emit click sounds (Norris, 1968), but some do not emit the so called pure tone.

No whistles have been reported in sound work on the primitive Amazon freshwater dolphin, *Inia geoffrensis* (see Schevill and Watkins, 1962; Schevill, 1964; Caldwell, Caldwell and Evans, 1966a, 1966b; Caldwell and Caldwell, 1967; Evans, 1967; Poulter, 1968; Caldwell and Caldwell, 1969b).

All of these earlier works contain two deficiencies. First, on only one brief occasion was work done with more than one or two animals in a tank (Caldwell and Caldwell, 1967). This lack of community tank sound studies constitutes a potentially serious deficit, as vocalizations of odontocete cetaceans of the marine species with which we have worked tend to diminish in relative number in captivity if other animals are not present. Second, several

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people handling *Inia* have reported a loud squeal or screech emitted by the animal which, from the observers' descriptions, might have been interpreted as a whistle (Allen and Neill, 1957; Layne and Caldwell, 1964; Caldwell, Caldwell and Evans, 1966b; Caldwell and Caldwell, 1969a, 1969b). This sound also has been described to us in personal conversation with Earl S. Herald of the Steinhart Aquarium, San Francisco; Lawrence Curtis, formerly of the Fort Worth Zoo, Texas; Leo Baumer of Iquitos, Peru; and W. J. LeBlanc and William C. Raulerson, Marineland of Florida. Until recently we had heard the sound out of water on one occasion, but did not record it. Further studies on this sound were thus considered necessary to determine whether these sounds are broad-band pulsed sounds and not a narrow-band whistle. Correction of these two deficiencies seemed mandatory, not only to help solidify our basic knowledge of cetacean phonations, but also because we have come to regard the absence or presence of the pure tone whistle as one of the significant characters in the precariously understood familial relationships between members of the order Cetacea. Evidence to date suggests that the species of cetaceans considered to be more primitive also either lack the *quasi*-pure tone whistle or that when present it is less clear-cut than in those species considered to be more advanced.

We recorded *Inia* phonations from a community tank over a period of two years for a total of some 25 hours. The dolphins were held in a large display tank at Marineland of Florida and at various times the community contained from four to eleven animals of mixed sizes and sexes. Sound recordings were made with the animals at rest or swimming slowly, feeding, fighting, copulating, sick, dying, and semi-stranded. The community tank contained eleven animals during one seven hour recording session of a semi-stranding. The animals were recent captives which, in our experience, along with stranding increases the possibility of eliciting at least a few cetacean phonations. Additionally we have air recorded isolated individuals as they were being handled and medicated, as well as during venipuncture and force feeding.

Within the range of our equipment (40 to 20,000 Hz), we have not detected *quasi*-pure tone sounds, nor did Evans (*in Herald, et al.*, 1969; personal conversation, August, 1969) indicate the production of such sounds in his studies of *Inia* phonations with equipment sensitive to frequencies up to 100,000 Hz. The loud squeals that we recorded are pulsed as shown when they are subjected to detailed analysis, and the *quasi*-pure tone or whistle is still unknown in the vocal repertoire of *Inia* and we believe now that it is not to be expected.

An adult female emitted squeals both singly and in series 22 and 19 times on two successive days when she was removed from her tank for medication. On another occasion this same female, although not being handled, intermittently emitted loud squeals for about an hour when the water level in her tank was so low that she was partly stranded; but no recordings were

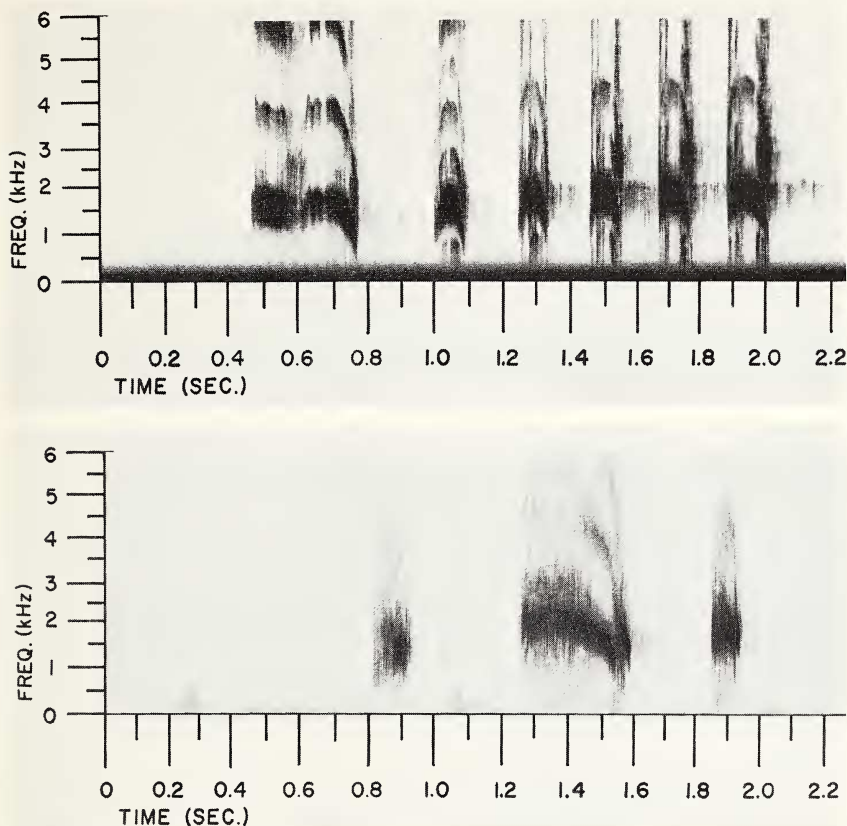


Figure 1. Phonations of *Inia geoffrensis*. Squeals emitted in air in daylight by isolated animals during application of medication. *Upper*: Adult female (MLF 165), January 27, 1969. *Lower*: Juvenile male (MLF 202), March 10, 1969. Effective filter bandwidths 300 Hz. (Photographs courtesy Marineland of Florida).

made. A juvenile male emitted seven squeals on one occasion when removed for medication and venipuncture. The four occasions are the only times of perhaps 30 to 40 in-air recording or listening sessions that the squeal was emitted by any individual of this species although all were subjected to the same amount of handling.

Sound spectrograms (sonograms) of the squeals of both animals (Fig. 1) show them to be the burst-pulse type with a high click repetition rate (Watkins, 1967). Although these are broad band clicks with some energy extending above 12 kHz (Fig. 2), a strong fundamental frequency at one to two kHz is demonstrated on the sonograms of the sounds of both animals (Fig. 1). These sonograms show several characteristics in common with the type 2

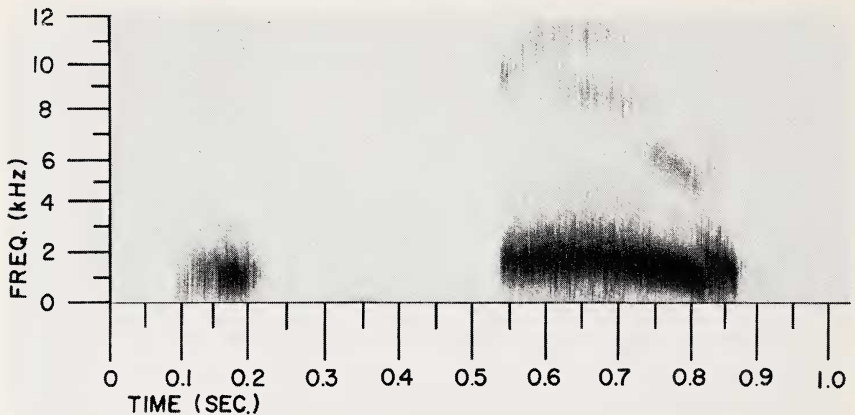


Figure 2. Phonations of *Inia geoffrensis*. First two of the same three squeals illustrated in Fig. 1 (lower), but played at half recorded speed. Effective filter bandwidth 600 Hz. (Photograph courtesy Marineland of Florida).

or complaint type of signal of the pilot whale, *Globicephala melaena*, (Busnel and Dziedzic, 1966: 615, fig. 11), the tin horn sound emitted when excited by a strong stimulus by the Pacific whitesided dolphin, *Lagenorhynchus obliquidens*, (Caldwell and Caldwell, 1967: 889, figs. 5-7), and the squawk component of the whistle-squawk emitted in air by an excited Atlantic bottle-nosed dolphin, *Tursiops truncatus*, (Caldwell and Caldwell, 1967: 897, fig. 22). Fundamental frequencies, depicted harmonics, and durations are similar in the four species. However, to the human ear the sounds are not alike.

SOUND EQUIPMENT

The recordings discussed in this paper were made with a Uher 4000 Report-L recorder operating at a tape speed giving it a frequency response of 40 to 20,000 Hz with a compatible Uher microphone. Sound spectrograms were prepared on a Kay Sona-Graph model 662A Sound Spectrograph Analyzer calibrated in two sections from 85 to 12,000 Hz. When the recorded tape speed is reduced by half, and then fed into the analyzer, the response of the latter is doubled to 24,000 Hz. The effective filter bandwidths used for the illustrated analyses are indicated in the figure captions.

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